D E C L A R A T I O N

I, NOBUAKI KATO, a Japanese Patent Attorney registered No. 8517, of Okabe International Patent Office at No. 602, Fuji Bldg., 2-3, Marunouchi 3-chome, Chiyoda-ku, Tokyo, Japan, hereby declare that I have a thorough knowledge of Japanese and English languages, and that the attached pages contain a correct translation into English of the priority document of Japanese Patent Application No. 7-007389 filed on January 20, 1995, in the name of CANON KABUSHIKI KAISHA.

I further declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made, are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

Signed this 22nd day of September, 1998

NOBUAKI KATO

PATENT OFFICE
JAPANESE GOVERNMENT

This is to certify that the annexed is a true copy of the following application as filed with this Office.

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[Title of the Invention] Animating Image Editing Apparatus and Animating Image Editing Method

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Specification

[TITLE OF THE INVENTION]

Animating Image Editing Apparatus and Animating Image Editing Method

[WHAT IS CLAIMED IS]

[Claim 1]

An animating image editing apparatus comprising:

first encoding means for encoding inputted animating image data by a coding method which pays an importance to a speed;

memory means for storing said animating image data encoded by said first encoding means;

editing means for editing said encoded animating image data; and

second encoding means for encoding said edited animating image data by a coding method which pays an importance to a compression ratio than said first encoding means.

[Claim 2]

An apparatus according to claim 1, wherein said first and second encodings are executed on the basis of a coding conversion program.

[Claim 3]

An apparatus according to claim 1, wherein said

second encoding means executes the encoding including an interframe encoding.

[Claim 4]

An apparatus according to claim 1, wherein said first encoding means executes an intraframe encoding.

[Claim 5]

An apparatus according to claim 1, wherein said edition is an edition on a frame image unit constructing said animating image data.

[Claim 6]

An apparatus according to claim 1, wherein said first encoding means executes a coding process to the input of said animating image data in a real-time manner.

[Claim 7]

An apparatus according to claim 1, further including display means for displaying said animating image data and instructing means for instructing the edition to said editing means,

wherein said editing means executes said edition in according with the instruction from said instructing means on said display means.

[Claim 8]

An apparatus according to claim 7, wherein said display means multi-screen displays said animating image data as a plurality of frame images.

[Claim 9]

An apparatus according to claim 8, wherein said

multi-screens are images obtained by reducing the frame images included in said animating image data.

[Claim 10]

An apparatus according to claim 7, wherein said edition denotes that the animating image data which is stored and encoded in said memory means is edited in accordance with the instruction of said instructing means.

[Claim 11]

An animating image editing apparatus comprising:

decoding means for decoding animating image data encoded by an encoding method including an interframe encoding;

encoding means for encoding the animating image data decoded in parallel with the decoding by said decoding means by an intraframe encoding; and

editing means for editing said encoded animating image data on a frame unit basis.

[Claim 12]

An apparatus according to claim 11, wherein said encoding and said decoding are executed on the basis of a conversion program.

[Claim 13]

An apparatus according to claim 11, further including display means for displaying said decoded animating image data.

[Claim 14]

An apparatus according to claim 11, further

including memory means for storing said edited animating image data.

[Claim 15]

An apparatus according to claim 11, further including accumulating means for accumulating the animating image data encoded by an encoding method including said interframe encoding.

[Claim 16]

An animating image editing apparatus comprising:

decoding means for decoding animating image data which was encoded by an encoding method including an interframe encoding and stored in a memory medium;

display means for displaying said decoded animating image data;

instructing means for giving an editing instruction to the animating image data displayed on said display means; and

encoding means for intraframe encoding the frame images of the minimum number which are necessary to decode the animating image data instructed by said instructing means in the animating image data stored in said memory medium.

[Claim 17]

An apparatus according to claim 16, wherein said encoding and said decoding are executed on the basis of a conversion program.

[Claim 18]

An apparatus according to claim 16, wherein said editing process is a cutting process of said animating image data.

[Claim 19]

An apparatus according to claim 16, wherein the encoding including said interframe encoding is an MPEG.

[Claim 20]

An apparatus according to claim 16, wherein said display means multi-screen displays said animating image data as a plurality of frame images.

[Claim 21]

An apparatus according to claim 20, wherein said multi-screens are images which are obtained by reducing the frame images included in said animating image data.

[Claim 22]

An apparatus according to claim 16, wherein said minimum number of frame images include the frame images instructed by said instructing means and are images of the number of frames such that said animating image data can be decoded without a broken link.

[Claim 23]

An animating image editing method comprising the steps of:

first encoding inputted animating image data by an encoding method which pays an importance to a speed;

storing said animating image data encoded by said first encoding step;

editing said encoded animating image data; and

second encoding said edited animating image data by an encoding method which pays an importance to a compression ratio than said first encoding step.

[Claim 24]

An animating image editing method comprising the steps of:

decoding animating image data encoded by an encoding method including an interframe encoding;

encoding the animating image data decoded in parallel with the decoding by said decoding step by an intraframe encoding; and

editing said encoded animating image data on a frame unit basis.

[Claim 25]

An animating image editing method comprising the steps of:

decoding animating image data which was encoded by an encoding method including an interframe encoding and stored in a memory medium;

displaying said decoded animating image data;

giving an editing instruction to the animating image data displayed on said display means; and

intraframe encoding the frame images of the minimum number which are necessary to decode the animating image data instructed by said instructing means in the animating image data stored in said memory medium.

[DETAILED DESCRIPTION OF THE INVENTION]

[0001]

[Field of the Industrial Utilization]

The present invention relates to animating image editing apparatus and animating image editing method for editing a coded animating image.

[0002]

[Prior Art]

Recently, coding methods of coding a digital animating image at a high compression ratio by using an interframe correlation have been standardized as internationl methods. There is an MPEG as a representative method. According to the MPEG, an interframe correlation is maximally used, a motion compensation is performed with reference to frames before and after a frame to be coded, and after that, an interframe differential coding is executed. Fig. 5 shows an example of the MPEG coding. In the coding frame types of the MPEG, I frame, P frame, and B frame have been coded as shown in the diagram. The I frame is the independent frame in an intraframe code and one frame is inserted per 15 frames. The P frame is a forward motion predictive frame and is an interframe code for performing the motion compensation by referring to the one-preceding P frame or the I frame. The B frame is an interframe predictive code for performing the motion compensation by predicting from both directions of the P and I frames before and after the B frame. The motion compensation is performed

on a unit basis of a block which is called a macro block (MB) as shown in Fig. 6. The MB is a unit such that an animating image is digitized at a sampling ratio of 4 : 1 : 1 of Y (luminance component) and Cb and Cr (color difference components) and, after that, Y (16 x 16 pixels), Cb (8 x 8 pixels), and Cr (8 x 8 pixels) are set to a block.

[0003]

[Problems to be solved by the Invention]

The motion compensation is executed in the B and P frames. Since the blocks having a strong correlation has to be searched (vector search) on a macro block unit basis, there is a drawback such that the processes of a coding unit are complicated as compared with those of a decoding unit. Particularly, when the coding is executed only by a software, it is difficult to execute it in a real-time manner. It is, therefore, a present situation that only the decoding is performed by a software. When the coding unit is realized by a hardware, there is a drawback such that the circuit scale is extremely large.

[0004]

As another problem, there is a problem at the time of the edition. Fundamentally, since the interframe difference is coded, it is difficult to perform a cut edition between arbitrary frames. For example, when an animating image is divided into two sequences at the position of (1) in Fig. 5, there is a drawback such that the last frame cannot be decoded in the preceding sequence and

the frames up to the next I frame cannot be decoded in the later sequence.

[0005]

As a method of solving the foregoing problems, there is an animating image processing apparatus using only the intraframe coding method without using the intraframe encoding method. For instance, there is a motion JPEG in which the JPEG system which is a coding of a color still image is independently applied to each frame of an animating image. In case of the motion JPEG, since the coding is also the intraframe coding, it is not so complicated as in the MPEG and a frame edition can be also freely performed. However, since the interframe correlation is not used, there is a drawback such that a compression efficiency is remarkably worse than that of the interframe coding.

[0006]

It is an object of the invention to provide an animating image editing apparatus and an animating image editing method which can solve the foregoing drawbacks.

[0007]

Still another object of the invention is to provide an animating image editing apparatus and an animating image editing method in which an amount of image data to be decoded is extremely suppressed when an editing process is performed for a predetermined frame.

[0008]

Futher another object of the invention is to provide

an animating image editing apparatus and an animating image editing method in which input an animating image data can be coded at a high speed and an image can be compressed at a high compression after edition.

[0009]

Further another object of the invention is to provide an animating image editing apparatus and an animating image editing method which can easily and promptly edit an animating image.

[0010]

Further another object of the invention is to provide an animating image editing apparatus and an animating image editing method which can edit an interframe coded an animating image while minimizing a deterioration of a picture quality.

[0011]

[Means for solving the Problems]

To solve the foregoing problems, the first invention comprises

first encoding means for encoding inputted animating image data by a coding method which pays an importance to a speed;

memory means for storing said animating image data encoded by said first encoding means;

editing means for editing said encoded animating image data; and

second encoding means for encoding said edited

animating image data by a coding method which pays an importance to a compression ratio than said first encoding means.

[0012]

Further, the second invention comprises

decoding means for decoding animating image data encoded by an encoding method including an interframe encoding;

encoding means for encoding the animating image data decoded in parallel with the decoding by said decoding means by an intraframe encoding; and

editing means for editing said encoded animating image data on a frame unit basis.

[0013]

Still further, the third invention comprises

decoding means for decoding animating image data which was encoded by an encoding method including an interframe encoding and stored in a memory medium;

display means for displaying said decoded animating image data;

instructing means for giving an editing instruction to the animating image data displayed on said display means; and

encoding means for intraframe encoding the frame images of the minimum number which are necessary to decode the animating image data instructed by said instructing means in the animating image data stored in said memory

medium.

[0014]

[Embodiments]

<First Embodiment>

Fig. 1 is a block diagram of the first embodiment. Reference numeral 1 denotes a video camera for inputting an animating image; 2 a capture board unit for forming each frame of the animating image; 3 a JPEG codec unit for performing intraframe coding and decoding (processing a program by a CPU 9); 4 a disk for accumulating animating images; 5 a video RAM unit for outputting the decoded animating image to a display 7; 6 an MPEG codec unit for coding/decoding an interframe coded animating image (processing a program by the CPU 9); 9 the CPU to control the apparatus. An animating image to be processed is inputted from the video camera 1 and is digitized by the video capture board unit. Reference numeral 19 denotes an operation unit including a mouse, or a pointer, which will be described hereinlater. In the embodiment, (360 pixels x 240 lines) construct one frame and digital animating images of 30 frames per second are formed. As pixel signals, the Y, Cb, Cr signals obtained by the sampling at the sampling ratio of (4: 1 : 1) which is performed by the MPEG or the like are used. The Y, Cb, and Cr signals formed by the capture board unit 2 are coded in the frame by the JPEG codec unit 3 through a computer bus 8 in a real-time manner. The coding is executed by the JPEG system by regarding each

frame as a still image on a frame unit basis.

[0015]

Since the JPEG coding system has been well-known, the description is omitted here. The coded animating images of 30 frames/second are stored into the disk 4 through the computer bus 8 in a real-time manner. In parallel with the coding, the digital animating images formed by the capture board unit 2 are sent to the video RAM unit 5 and are converted to the RGB signals for displaying the animating images and, after that, the images are displayed by the display 7 in a real-time manner. By the processes as mentioned above, while the animating image inputted from the video camera 1 is displayed by the display 7 in a real-time manner, the image is coded by the JPEG codec unit 3 and the coded data is stored into the disk 4. The input of the animating image to the disk 4 is continued until one animating image scene (hereinafter, referred to as a sequence) is finished. One sequence after completion of the input is reproduced on the display 7 as necessary. The reproducing process is performed as follows. Codes of one sequence are sequentially read out on a frame unit basis and are sent to the JPEG codec unit 3 which can perform the coding at a speed higher than that in the MPEG through the computer bus 8 and are decoded. The decoded frames are sequentially transferred to the video RAM unit 5 on the frame unit basis as Y, Cb, and Cr signals of (360 pixels x 240 lines) and are displayed by the display 7 in a manner

similar to the case of the foregoing real-time animating image input display (hereinlater, such an operation is called as a normal reproduction).

[0016]

When one animating image sequence is inputted, generally, unnecessary portions are often included at the positions before and after or in the halfway of the sequence. According to the embodiment, therefore, the editing process is performed by using a feature of the intraframe coding such that each frame is independent.

Fig. 2 shows an example of edition. Reference numeral 7 denotes the display in which an edition window 10 is displayed. In the edition window 10, each frame of the sequence of the decoded animating image is displayed in a reduced size. As for the reduction, a normal method of simply thinning out is used and a resolution is decreased to a value such that the contents can be known, thereby enabling a few frames to be simultaneously displayed. Reference numeral 15 indicates a frame as a target point at the time of the edition. Reference numeral 14 denotes a one-preceding frame; 13 a two-preceding frame; 12 a three-preceding frame; 16 a one-later frame; 17 a two-later frame; and 18 a three-later frame.

[0017]

In case of the normal reproduction, a frame of a size of (360 pixels x 240 lines) is displayed in another window (not shown). At the time of the edition reproduction,

however, since a plurality of frames before and after the target frame are displayed as mentioned above, the pixels reduced to about (1/4 x 1/4) are reproduced. In the edition reproduction, the frame 15 is set to a reproduction point and the frames before and after such a frame are moved and displayed as shown by an arrow. The frames are displayed in a normal speed mode, a slow speed mode, sequential frame display mode, or the like as necessary. Reference numeral 11 denotes an edition tool bar for cutting unnecessary frames and for selecting only necessary frames. Fig. 2 shows a state in which the frames 13 to 17 are selected (bars of the hatched portions) by a mouse or a pointer. In this case, the frames before the frame 12 and the frames after the frame 18 are unnecessary portions. The frames other than the necessary portions selected as mentioned above are deleted and edited from the disk 4. Since the code data stored in the disk 4 are the intraframe coded data, it can be easily edited. In the embodiment, the editing process is executed by the CPU 9 in a software manner. The edited code data can be confirmed by performing the normal reproduction as mentioned above.

[0018]

The editing process mentioned above is performed on the basis of the intraframe code data which can be easily edited. After the edition, the intraframe code is converted to the interframe code having a compression efficiency higher than that of the intraframe code and the animating

image is efficiently restored to the disk 4. One sequence of the edited intraframe codes stored in the disk 4 is read out every frame and is decoded by the JPEG codec unit 3 in a manner similar to the normal reproduction. Since there is no need to again convert the intraframe code to the interframe code in a real-time manner, however, it is sufficient for the JPEG codec unit 3 to decode in accordance with the speed of the interframe coding. In the embodiment, the MPEG system is used to gain encode the decoded animating image to the interframe coded frame image. Since the re-encoding is performed by a software by the CPU 9, it is executed by an idle time of the CPU.

According to the MPEG coding, as shown in Fig. 5, the data is interframe/intraframe coded into three kinds of frame types of I, P, and B frames. The coded frames are again sequentially stored into the disk 4 in accordance with the order from the frame after completion of the coding and the above operation is continued until the end of the sequence, thereby finishing the re-encoding. After that, by deleting an unnecessary sequence of the intraframe codes, it is converted to the sequence in which the compression efficiency is improved so that the disk 4 is efficiently used.

[0019]

As mentioned above, the animating image sequence which was re-encoded to the interframe codes is sequentially decoded by an MPEG codec 6 as necessary and can be also

similarly produced to the display 7 via the video RAM unit 5.

[0020]

As mentioned above, the input of the animating image is coded by the intraframe coding in a real-time manner, so that the coding can be easily performed with a small circuit scale as compared with the case of using the interframe coding by the MPEG. By using the intraframe code, the animating image can be easily edited. By converting the intraframe code to the interframe code of a good compression efficiency after the edition, the animating image process such that the input edition of the animating image is easy and the compression efficiency is high is realized.

[0021]

<Second Embodiment>

Fig. 3 is a diagram showing the second embodiment. The second embodiment relates to a case where animating images have already been converted to digital codes and stored in a CD-ROM or the like. In Fig. 3, reference numeral 20 denotes a CD-ROM player which is connected to the computer bus 8 by an SCSI bus. In Fig. 3, the same component elements as those in Fig. 1 are designated by the same reference numerals. The CD-ROM player 20 is an animating image reading apparatus for displaying animating image data generally stored in the CD-ROM onto the display 7. Codes are read out from the CD-ROM player 20 at a predetermined bit rate. It is generally desirable that such a kind of animating images for accumulation have been

interframe coded from a view point of the compression efficiency. In the second embodiment, a case where the animating image coded by the MPEG system is read out from the CD-ROM will be described. Codes of one sequence read out from the CD-ROM player 20 are decoded by the MPEG codec 6 via the computer bus 8 in a real-time manner. The frame images (360 pixels x 240 lines; Y, Cb, and Cr signals) sequentially decoded are again sequentially converted every frame to the JPEG codes as intraframe codes by the JPEG codec unit 3 through the computer bus 8. Simultaneously, the frame images decoded by the MPEG codec 6 are normally reproduced onto the display 7 via the video RAM unit 5. The sequence coded by the JPEG codec unit 3 is sequentially stored into the disk 4 by an amount corresponding to a sequence of a necessary length. After completion of the storage, as described in the first embodiment, the frame edition can be performed as necessary. It is also possible to again convert the intraframe code to the interframe code in order to raise the compression efficiency.

[0022]

As mentioned above, while decoding the interframe coded animating image, by re-encoding to the intraframe code, the edition on the frame unit basis can be promptly and easily performed.

[0023]

<Third Embodiment>

In the second embodiment, although the MPEG codes

have been decoded and converted to the intraframe codes with respect to all of the sequences, only the neighboring frames to be edited can be also converted to the intraframe codes as follows. In Fig. 3, in a recording medium (the CD-ROM in the third embodiment) which can perform the optical recording, magnetic recording, or the like, the MPEG codes (interframe codes) stored in the CD-ROM are decoded by the MPEG codec 6 and only the display operation is performed. In this instance, the re-encoding by the JPEG codec unit is not executed. As for the display, the edition reproduction is performed as described in Fig. 2. As mentioned above, the necessary portions are designated by the edition tool bar 11. In the case where the editing portions have been interframe coded, however, the frame edition cannot be easily performed. Therefore, a partial intraframe coding conversion as shown in Fig. 4 is executed. As an interframe code, the I, P, and B frames are encoded every fifteen frames between the I frames by the MPEG encoding as described in Fig. 5.

[0024]

For example, in case of cutting the portion of (1) between the B frames in each of the second and third frames in Fig. 4, the last B frame of the previous sequence of the cut portion cannot be reproduced. In the later sequence, a state in which up to the next I frame cannot be reproduced (broken link) occurs. In the embodiment, therefore, four frames between the P frames (between the I and P frames in

case of the I frame) including the cut portion are decoded and are again encoded to the I frame, so tha the frame edition at an arbitrary position can be performed. Four frames including the portion to be cut in the sequence which was read out from the CD-ROM player 20 in Fig. 3 are decoded by the MPEG codec 6 and can be also partially again encoded as an intraframe by the CPU 9 in an operational processing, i.e., a software manner. In place of again encoding to the intraframe in a software manner, the intracoding can be also performed by the JPEG codec 3. Instead of decoding all the encoded frames, by partially again encoding to the intraframe code only frame images in minimum number including frame images indicated to be edited upon editing, in which the frames which are not edited can be reproduced later, as in the embodiment, there is no need to again encode to the interframe code for the purpose of the improvement of a compression ratio after the edition. A deterioration of the picture quality can be also minimized to the portions before and after the edition.

[0025]

[Effect of the Invention]

As described above, accoridng to the present invention, with the first invention, it is possible to encoding input animating image data easily at a high speed with a comparatively small scale in circuit and to make any frame edition and also to effect the animating image process with a high compression efficiency in the animating image

data after edited.

[0026]

With the second invention, it is possible to make the animating image edition which is capable of rapidly editing the animating image data subjected to an intraframe encoding.

[0027]

With the third invention, frame images to be decoded among the animating image data subjected to an intraframe encoding is minimized, so that the edition can be effected with deterioration in image quality suppressed to a minimum.

[BRIEF DESCRIPTION OF THE DRAWINGS]

Fig. 1 is a diagram showing the first embodiment;

Fig. 2 shows an example of a display picture plane for edition;

Fig. 3 is a diagram showing the second embodiment;

Fig. 4 shows an example such that an intraframe coding was performed to a part of a sequence;

Fig. 5 is a diagram showing a state of a sequence when an interframe coding is performed; and

Fig. 6 is as diagram showing a macro block.

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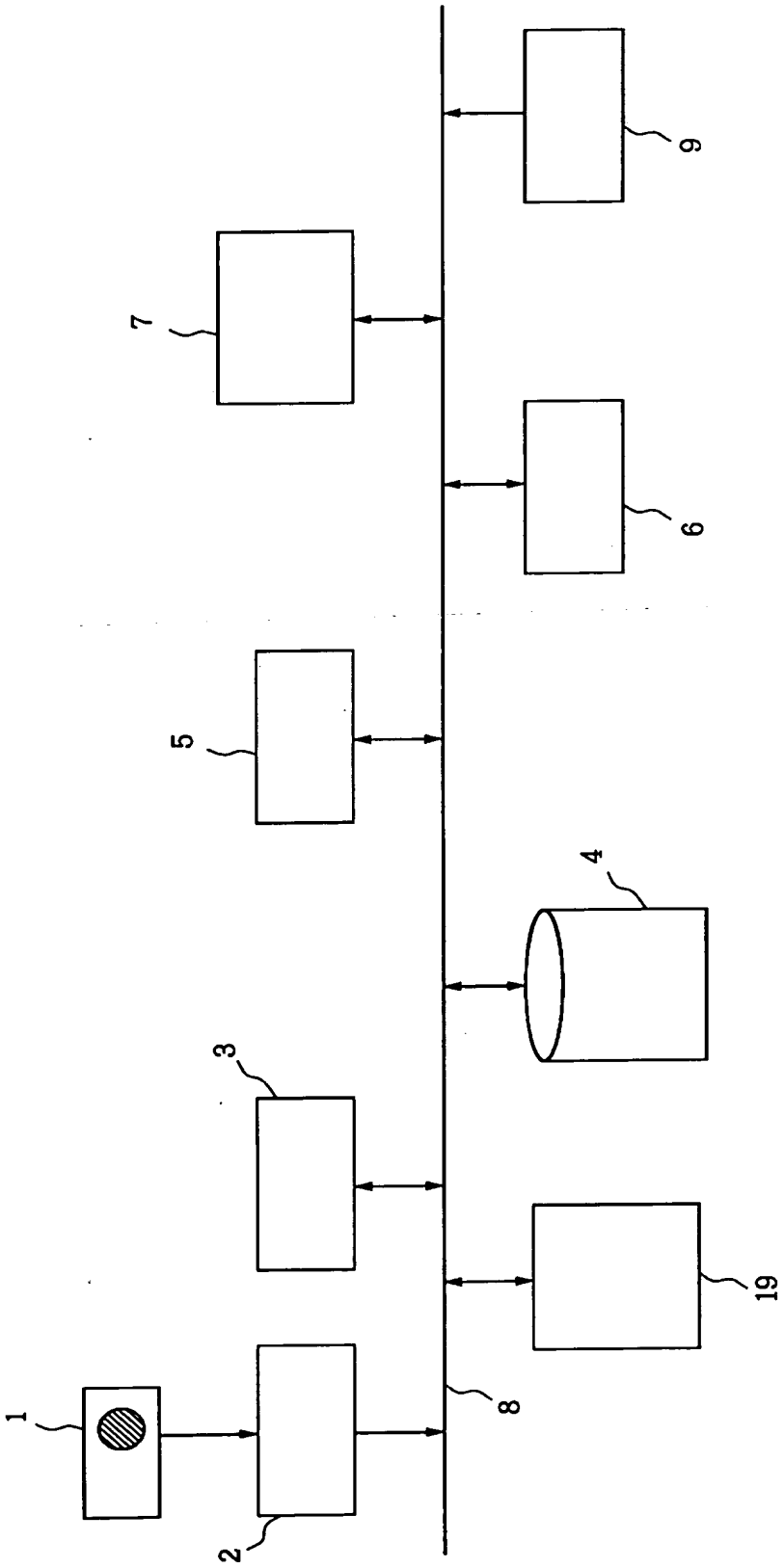
コード 【書類名】 (Name of the Document) 図面 Drawings

【図1】 Fig. 1

イメージ



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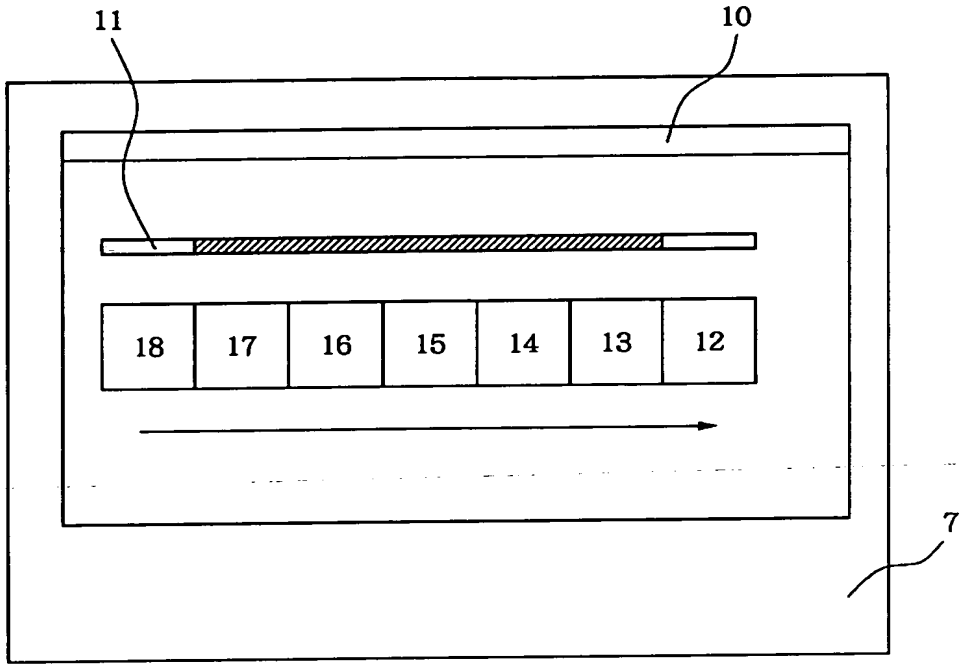
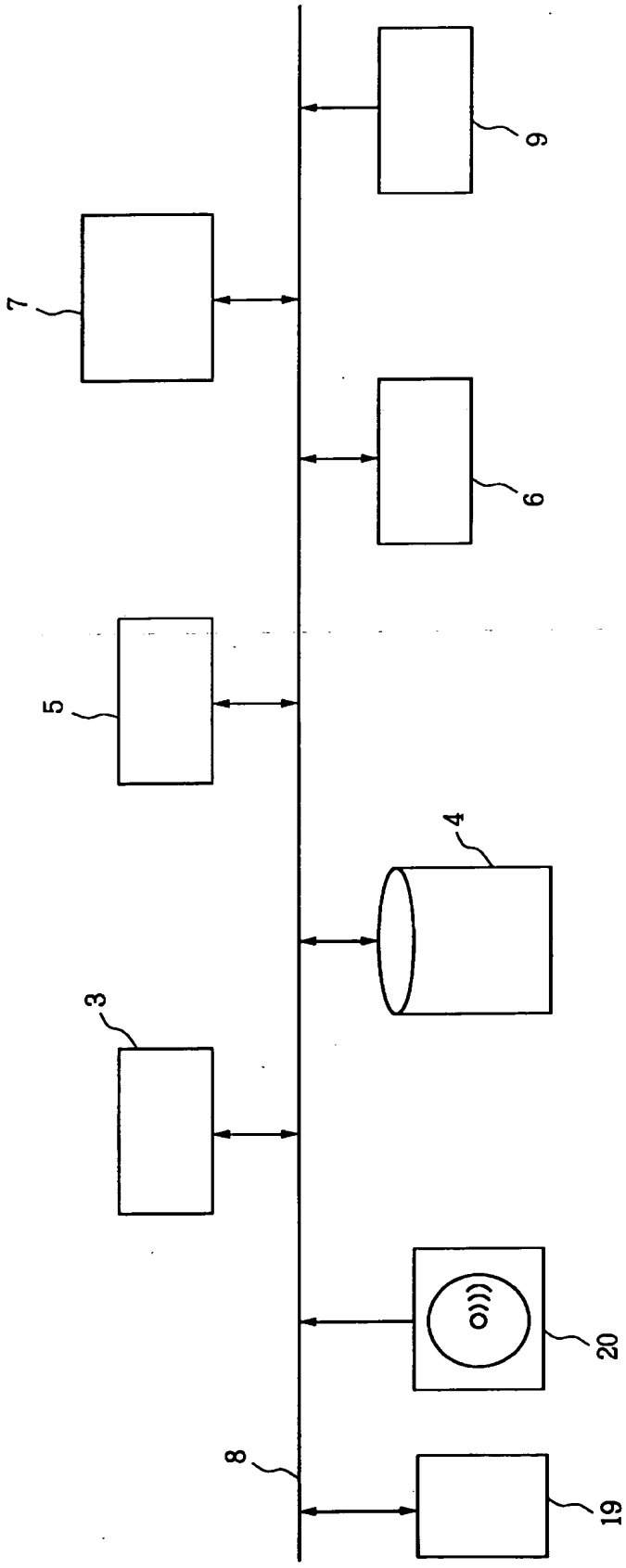
コード 【図２】Fig. 2

イメージ




9
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19

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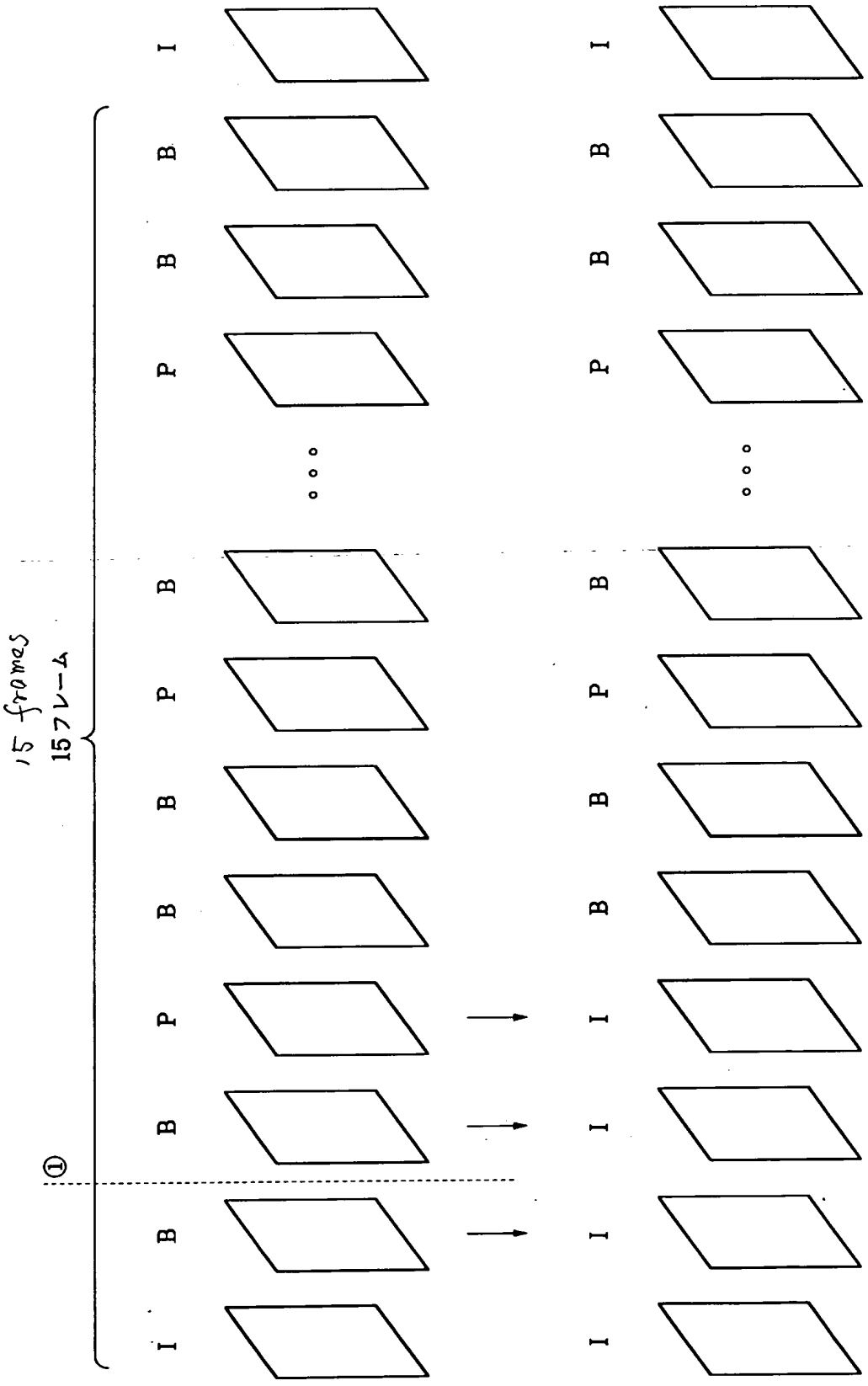
コード 【図4】 Fig. 4

イメージ



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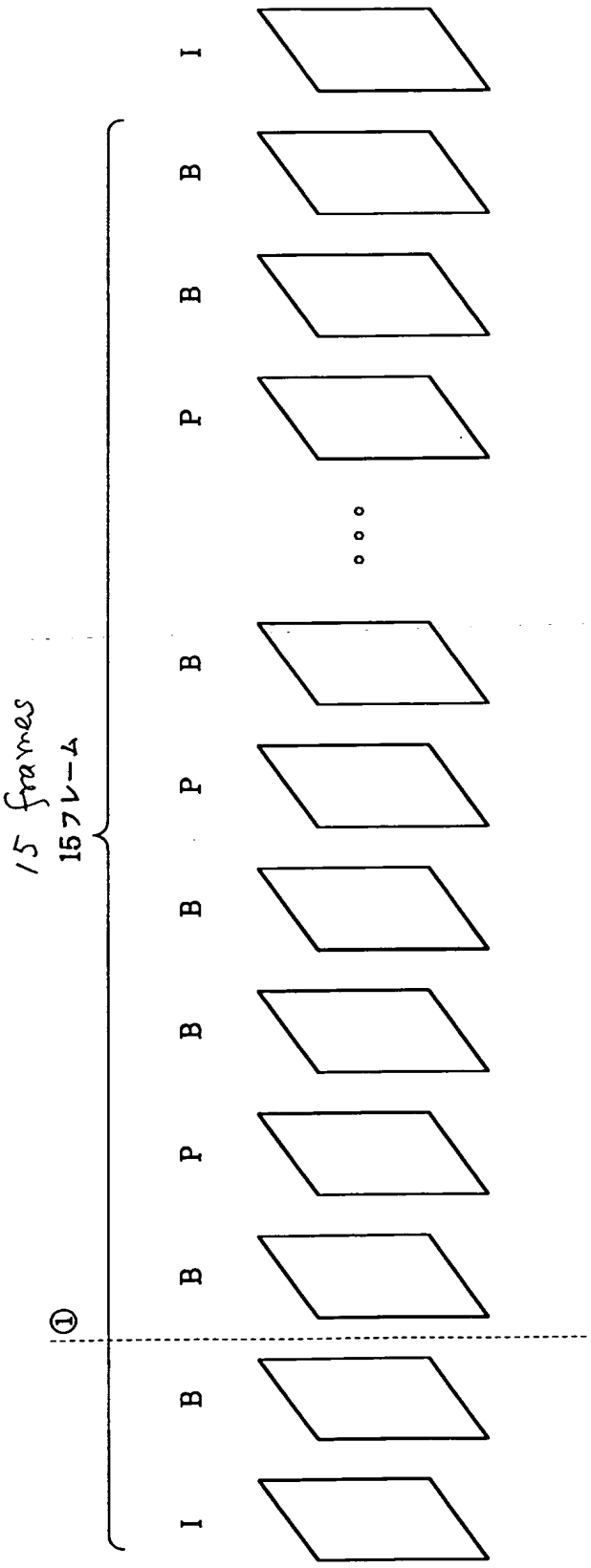
コード 【図5】 Fig. 5

イメージ



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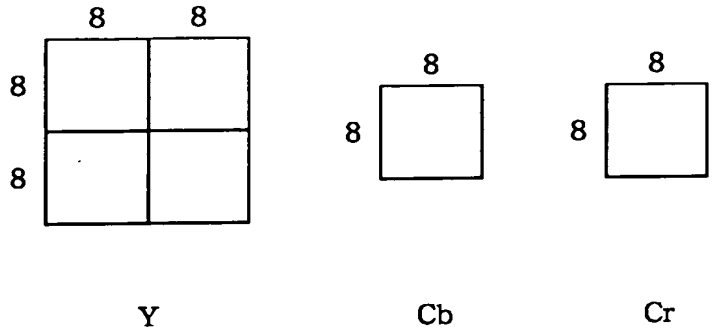
コード 【図６】 Fig. 6

イメージ



[NAME OF THE DOCUMENT] Abstract

[Abstract]

[Object]

To make the animating image edition possible while minimizing a deterioration of intraframe encoded animating images.

[Constitution]

The method comprises the steps of decoding animating image data which was encoded by an encoding method including an interframe encoding and stored in a memory medium; displaying said decoded animating image data; giving an editing instruction to the animating image data displayed on said display means; and intraframe encoding the frame images of the minimum number which are necessary to decode the animating image data instructed by said instructing means in the animating image data stored in said memory medium.

[Elected Drawing] Figure 4